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INDICATORS FOR INTEGRATED COASTAL ZONE MANAGEMENT (ICZM): *Methodological Factsheets in support of comparable measurements and an integrated assessment in coastal zones*

The **ICZM Protocol for the Mediterranean Sea** (the 'ICZM Protocol'), signed in Madrid on 21 January 2008 and ratified on 24 March 2011, represents a milestone for the implementation of ICZM in the Region and can serve as a blueprint for the implementation of ICZM in other Regional Seas. The **PEGASO project** builds on existing capacities and develops common approaches to support integrated policies for the Mediterranean and Black Sea Basins in ways that are consistent with the ICZM Protocol.

The PEGASO project has developed **a core set of indicators** that are instrumental in measuring the implementation of ICZM policies and programmes. The core set of ICZM indicators addresses the specific requirement of Article 27 of the protocol to '*define coastal management indicators*' and '*establish and maintain up-to-date assessments of the use and management of coastal zones*'. In doing so, the PEGASO project has widely built on previous and existing indicator sets, developed by different institutions and projects, and which are duly acknowledged (see '[Methodological paper for the selection and application of PEGASO ICZM indicators](#)' for further reading and background material)

The present Methodological Factsheets is part of a set of 15 factsheets that are made available to end-users. This set of factsheets supports a harmonized approach to calculate ICZM indicators at different spatial scales in the Mediterranean and Black Sea regions

Name of the Indicator	
Trends in the amount of litter washed ashore and/or deposited on coastline	
Objective of the indicator	
<p>Marine litter is any persistent, manufactured or processed solid material discarded, disposed or abandoned in the marine and coastal environment. Marine litter consists of items that have been made or used by people and deliberately discarded or unintentionally lost into the sea and on beaches including such materials transported into the marine environment from land by rivers, draining or sewage systems or winds.</p> <p>For example, marine litter consists of: plastics, wood, metals, glass, rubber, clothing, paper etc. This definition does not include semi-solid remains of for example mineral and vegetable oils, paraffin and chemicals that sometime litter sea and shores.</p> <p>An overriding objective will be a measurable and significant decrease (e.g. 10%/year for litter on coastlines) in the total amount of litter in the environment by 2020.</p> <p>The attribute will indirectly measure inputs, impacts on aesthetic values, the presence of toxic compounds and socio-economic damage.</p> <p>Quantities, composition and distribution of litter, including the distribution and concentrations of degradation products of litter (microparticles in sediments and the water column) as well as impact rates on organisms and the potential chemical pollution resulting from plastics are good trend indicators of degradation through marine litter and may monitor direct impact in the marine environment.</p> <p>Monitoring the quantities and distribution of litter in the different compartments of the marine environment will give a basis for actual and potential assessment of socio-economic and ecological impacts of litter. Impacts on organisms, distribution and concentrations of microparticles and chemical burdens monitor direct effects on the marine ecosystem.</p>	
Policy context	
ICZM Policy Objective	To perform Environmental Impact Assessment for human activities and infrastructures
ICZM Protocol Article	Article 9: <i>Economic activities</i>
UNEP-MAP Ecological Objective	Objective 10: <i>Marine and coastal litter do not adversely affect coastal and marine environment</i>
INSPIRE ANNEX I-III Data Theme (34)	Annex III
CALCULATION OF THE INDICATOR	
Spatial consideration	
Coverage	Resolution - Reporting unit(s)
Coastal and marine regions of the Mediterranean and Black Sea (beaches, sea surface, water column, sea floor and sediment)	The reporting units are defined by the different procedures established in protocols and/or tools to evaluate marine and coastal litter (see 'tools' below)
Temporal consideration	
Period	Resolution (time interval or unit)
Because the litter will persist in the water column and on the sea floor/sediment, long term monitoring in the marine environment will be required.	<p>Annual data. Where relevant, due to climate/hydrology/oceanographic conditions, seasonal variations need to be taken into account.</p> <p>Much like the spatial reporting units, temporal resolution may also be defined by the procedurs in protocols and tools (see 'tools' below).</p>

Parameter(s)	
	Note: the 'parameters' described below, correspond with different tools and their procedures. Different procedures are needed according to the type or component of the environment that is being monitored. In the present factsheet, the different tools are listed and briefly commented in terms of methodology and requirements, spatial coverage and frequency.
(i)	MSFD Marine Litter Monitoring TOOL SHEET: Beach litter monitoring
(ii)	MSFD Marine Litter Monitoring TOOL SHEET: Sampling meso beach litter 5 mm - 25 mm size
(iii)	MSFD Marine Litter Monitoring TOOL SHEET: Visual surface observation from ship
(iv)	MSFD Marine Litter Monitoring TOOL SHEET: Surface observation from air
(v)	MSFD Marine Litter Monitoring TOOL SHEET: Surface trawl
Method : Tools, Specifications, Procedures	
(i)	<p>MSFD Marine Litter Monitoring TOOL SHEET</p> <p>Tool name: Beach litter monitoring</p> <p>Indicator for which the tool is to be applied: 10.1.1</p> <p>Tool code: 10.1.1_T1</p> <p>Tool description: Surveys of litter on beaches are a primary tool for monitoring the load of litter in the marine environment and have been used world-wide to quantify and describe marine litter pollution. Counting the number of individual items provides the best, easiest and cheapest information for formulation of management measures at all levels (linking items to sources and uses). It is also the most practical method; other additional methods can be valuable: e.g. the assessment of the weight of the items found.</p> <p>Technical requirements: The beach litter monitoring surveys should take place on selected beaches which are marked by reference landmarks or GPS coordinates. The entire 100 m beach stretch should be surveyed from the tide line to the structures forming the border of the back of the beach (dunes, sea wall etc.). Litter items found on the beach should be registered using a standard list of items. All the items should be counted. The identification of items should be assisted by the use of a photo guide which is included in the guidelines. During the monitoring session the litter should be removed from the beach.</p> <p>Size range: Although in line with the OSPAR methods no lower size limit is proposed, litter items smaller than 2.5 cm should be assessed additionally (in line with the NOAA protocol) using the method for meso-litter on beaches, described in Tool sheet 10.1.1_T2. The assessment of microplastics in beach sediments is also included in Chapter 7 (Task 6).</p> <p>Spatial coverage: Survey area length 100 m; width determined by geography of the beach.</p> <p>Survey frequency: At least four times a year.</p> <p>Regional applicability of the tool: method can be applied in all regions of the EU. Regional differences in items and their sources will need to be taken into account.</p> <p>Source related information: Material, items and categories are linked to sources. A hierarchical categorization system should be developed which groups items according to their type, application and allocates them, where possible, to different sources. This should be compatible with other indicators.</p>

(ii)	<p>MSFD Marine Litter Monitoring TOOL SHEET</p> <p>Tool name: Sampling meso beach litter 5 mm - 25 mm size</p> <p>Indicator for which the tool is to be applied for: 10.1.1</p> <p>Tool code: 10.1.1_T2</p> <p>Tool description: Sampling fragments of litter from beaches in the 'meso' size range (5 mm – 25 mm). Sediment is collected from within a 50 cm x 50 cm quadrat using a metal trowel or scoop to a depth of 3 cm. Material is sieved (5 mm sieve) and fragments of litter removed and stored for further analyses. Further analyses should include counting the number of items, categorizing according to material type (plastic, glass, metal), use (where possible e.g. bottle cap closure), shape and colour. It may be necessary to use FT-IR spectroscopy (see tool sheets on microlitter) to confirm the identity of some pieces.</p> <p>Technical requirements: Quadrat 50 cm x 50 cm, metal trowel or scoop, 5 mm sieve.</p> <p>Size range: Meso beach litter 5 mm – 25 mm size.</p> <p>Spatial coverage: Tool can be used to sample mesolitter on beaches from a series of replicate quadrats randomly distributed along the beach. The tool could most effectively be considered as an extension of the protocols used to sample larger items of beach litter which are described in Toolsheet 10.1.1_T1, alternatively it could be conducted at the same time as monitoring microlitter on beaches. Hence spatial extent for this monitoring approach will most logically be dictated by the overall number of beaches sampled for macro or microlitter.</p> <p>Survey frequency: As for macro beach debris described in Toolsheet 10.1.1_T1</p> <p>Regional applicability of the tool: Widely applicable but not yet used.</p> <p>Source related information: Information could be compiled in spatial data base and linked with hydrodynamic and meteorological conditions, analysis of sampled material, categories, shapes</p>
(iii)	<p>MSFD Marine Litter Monitoring TOOL SHEET</p> <p>Tool name: Visual surface observation from ship</p> <p>Indicator for which the tool is to be applied for: 10.1.2</p> <p>Tool code: 10.1.2_Water T1</p> <p>Tool description: Visual observation of a surface sample area by observers.</p> <p>Technical requirements: Ship (of opportunity), observation without binoculars.</p> <p>Size range: 2.5 cm (depending on survey set-up) – limited by observation area/item occurrence density.</p> <p>Spatial coverage: Hours of observing transects (x m width of transect) at vessel speed.</p> <p>Survey frequency: Several times a year, also depending on opportunities.</p> <p>Maturity of the tool: In use for years, need for harmonisation and scientific studies on comparability between different observation set-ups and representativeness (Cameras can be an option for automatized surveys).</p> <p>Regional applicability of the tool: Weather dependency, calm sea required.</p> <p>Source related information: Coordinates linked with hydrodynamic and meteorological conditions, categories, shapes.</p>
(iv)	<p>MSFD Marine Litter Monitoring TOOL SHEET</p> <p>Tool name: Surface observation from air</p> <p>Indicator for which the tool can be applied: 10.1.2</p> <p>Tool code: 10.1.2_Water T2</p> <p>Tool description: Visual observation of a surface sample area by observers from airplane.</p> <p>Technical requirements: Airplane, slow speed, observation without binoculars.</p> <p>Size range: min: 30-40 cm (depending on altitude) – max: limited by sample area.</p> <p>Spatial coverage: Hours of observing transects (x m width of transect) at airplane speed and altitude.</p> <p>Survey frequency: Several times a year, also depending on opportunities.</p> <p>Maturity of the tool: In use for years, need for harmonisation and scientific studies on comparability between different observation set-ups and representativeness.</p> <p>Regional applicability of the tool: Weather dependency.</p> <p>Source related information: Coordinates linked with hydrodynamic and meteorological conditions, categories, shapes.</p>

- (v) **MSFD Marine Litter Monitoring TOOL SHEET**
Tool name: Surface trawl
Indicator for which the tool is to be applied for: 10.1.2
Tool code: 10.1.2_Water T3
Tool description: Towing of trawl net on surface.
Technical requirements: ship, trawl net.
Size range: 333 µm – e.g. 2.5 cm (max size for representative sampling depending on net type and survey design).
Spatial coverage: Examples: High speed trawl: 30 min at 6 knots (15.5 cm x 50 cm (20 cm in water)).
Low speed trawl: 15 min at 1-2 knots (100 cm x 30 cm)
Survey frequency: Likely to be based on existing cruises for fish stock assessment and limited by weather conditions.
Maturity of the tool: In use for years, further harmonisation and scientific studies on comparability of different designs and sampling representativity needed.
Regional applicability of the tool: Limited by prevailing weather conditions
Source related information: Coordinates linked with hydrodynamic and meteorological conditions, analysis of sampled material, categories, shapes.

Current monitoring		Data sources	
Methodological standards in Europe are currently available for the assessment of: <ul style="list-style-type: none">Litter on coastlines: In the OSPAR, HELCOM and Black Sea regions, standards for the Beach Litter Survey have been developed which could, be adjusted, harmonized and applied to other regions.Litter at sea. Pilot projects indicated that litter on the sea floor could be measured alongside international biological trawling surveys (e.g. IBTS) or dedicated dive or photographic transects. Impact of "ghost" in the water column nets will be considered in fishing areas.		<p>Mediterranean:</p> <p>The findings of the “Assessment of the status of marine litter in the Mediterranean” (2011) illustrate that although useful data on types and quantity of marine litter exists in the region, it is inconsistent and geographically restricted mainly to parts of the North Mediterranean.</p> <p>http://www.mio-ecsde.org/uploaded_files/news/wg%20357%20inf%204%20assessment%20of%20status%20of%20marine%20litter.pdf</p> <p>Black Sea:</p> <p>Important data on permanent sources of marine litter have been published by Turkish specialists. Solid waste management is one of the main environmental problems in the Black Sea Region (BSC, 2007).</p>	
Assessment context			
Use of the indicator in previous assessments/initiatives	UNEP produced guidelines on surveying litter on coastlines in 2009 which dealt comprehensively with the methods available to assess litter on the coast (Cheshire et al., 2009). The UNEP Guidelines are being considered for application in the Black Sea region. Recommendations for monitoring litter on the coastline in the Baltic Sea region were adopted in March 2008 (HELCOM RECOMMENDATION 29/2, March 2008), which are based on the UNEP Guidelines. HELCOM advise to update this Recommendation according to international developments on this issue to ensure harmonized approach on a global scale. An OSPAR Beach Litter Monitoring Program has been running in the Northeast Atlantic region since 2001 (OSPAR, 2007a, 2009), which is compatible to the UNEP guidelines More complex guidelines see http://www.unep.org/regionalseas/marinelitter/publications/docs/Marine_Litter_Survey_and_Monitoring_Guidelines.pdf		
DPSIR framework	Pressures		
Link to anthropogenic pressure	Maritime activities		
Sustainability target or			

threshold	
Link with other assessment tools	
Example of integrated assessment	UNEP-MAP plan Bleu : State of the environment and development in the Mediterranean 2009 MEDPOL reports : Assessment of the status of marine litter in the Mediterranean, 2011
Scope for future improvements	
Indicator references (i.e. UNEP, EEA, ...)	
Floating litter The abundance of floating debris at sea can be estimated either by direct observation of large debris items, by net trawls for smaller items or by aerial surveys (Ryan et al., 2009; Herr, 2009). UNCSO-RIO+20, UNEP initiative on marine litter, UNEP-MAP: http://www.unep.org/regionalseas/marinelitter/publications/default.asp SDI for ICZM in the South-East Baltic : http://corpi.ku.lt/SDI-4-SEB/state/17.pdf	

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